C1 Going on growing

Learn about:
- Types of microorganism
- Useful microorganisms

Unseen microorganisms

Some food goes mouldy if you leave it out in the air. You have probably seen blue-grey mould growing on old bread.

In 1881, Louis Pasteur proved that food decayed because 'germs' we can't see land on it from the air. Germs are tiny living things called **microorganisms**.

Do you remember?

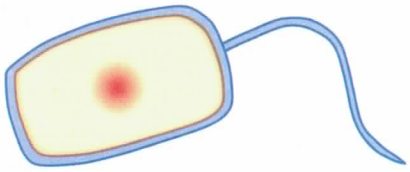
Microorganisms feed, grow and reproduce like any other organism. Cells reproduce by dividing to make new cells.

A microorganism is a living thing that is so small it can only be seen clearly with a microscope. Microorganisms are sometimes called **microbes**. Many of them are only a fraction of a millimetre long. To describe their size, scientists use a unit called the **micrometre** (μm).

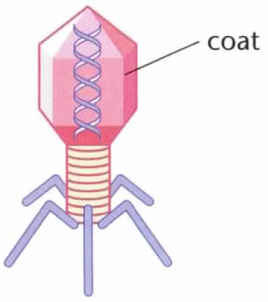
$1\,\mu m = \frac{1}{1000}\,mm = \frac{1}{10\,000}\,cm = \frac{1}{1\,000\,000}\,m$

Types of microbe

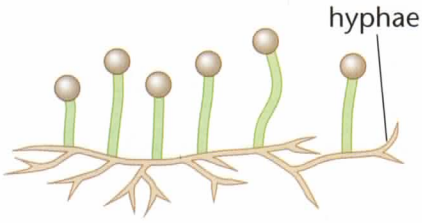
There are very many types of microbe. There are more microbes on the skin of one person than there are humans on the Earth! There are three main types of microbe:



Bacteria are very small, usually about 1 μm across. A bacterium is a unicellular organism. Bacterial cells have a cell wall, but do not have a nucleus. They reproduce by cell division.



Viruses are much smaller than bacteria. They are not made of cells.



Fungi (singular **fungus**) are larger than bacteria. Some fungi, such as yeast, are small and round. Others, like mould, are made of long threads called **hyphae**. These threads can only be seen clearly under a microscope.

a **Some scientists have argued that viruses are not living. Suggest a reason for their argument.**

Useful microbes

The photos opposite show some of the ways that we use microbes.

Fungi are used to make products like those shown below.

Quorn is made from fungi.

Moulds are used to make blue cheese.

Bacteria are used to make products like those shown below.

Bacteria are used to make yoghurt and cheese.

b **Andy's mum told him that all microbes are dangerous. Was she right? Explain your answer.**

Growing well

To grow well and reproduce quickly, microbes need to be kept warm and moist and have plenty of food. Microbes respire, but not all microbes need oxygen. For example, yeast can respire without oxygen.

To make wine, yeast is mixed with water and grape juice and left in a warm place. The yeast feeds on the sugar from the grapes, making ethanol. The yeast cells continue to reproduce by dividing into two until they start to compete for food and space. Also, the ethanol builds up and slowly poisons the yeast.

c **What do microbes need to grow well?**

Waste removal

Bacteria break down the dead bodies of plants and animals, and their waste products. These bacteria are used in sewage farms to break down our sewage. Some bacteria live inside the intestines of animals such as rabbits and help to digest cellulose in their food.

Did you know?

There is a type of bacterium living in your gut called *E. coli*. If the conditions are right, it will divide every 20 minutes!

Questions

1. Draw a diagram of a bacterium, a virus and a fungus. Put them in order of size, smallest first, and label their key features.
2. Make a table listing some uses of fungi and bacteria.
3. Give three differences between viruses and bacteria.
4. Imagine that scientists have discovered a way to kill every single type of microbe on the planet. Write a story about how this would have a serious effect on our lives.

For your notes:

- There are three main groups of **microorganisms**: **bacteria**, **viruses** and **fungi**.
- Bacteria and fungi reproduce by cell division.
- **Microbes** can be very useful to us.

C2 Defence systems

Learn about:

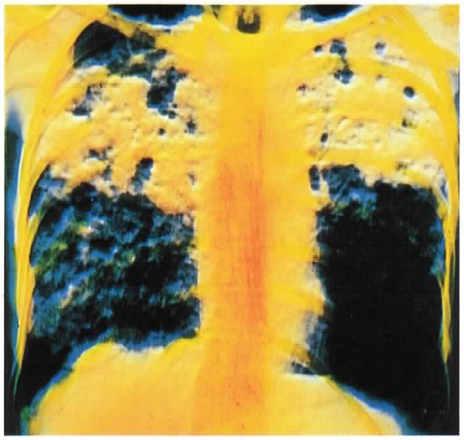
- Microorganisms that cause disease
- How the body fights infection

Disease

The air around you is full of microbes. Your body is covered in them. Many microbes are harmless and most of the time you are healthy. But some microbes can cause **infections** or diseases if they get inside your body. You have probably had a cold or other infections at times. Organisms that cause disease are called **pathogens**.

Do you remember?

Some illnesses, for example chickenpox, food poisoning and colds, are caused by microorganisms. They also cause boils and tooth decay!



TB is a serious disease caused by bacteria. They have damaged the parts of the lungs shown yellow in this X-ray.

Bacteria attack body cells and release poisonous chemicals (toxins) which kill cells and make you feel ill. Diseases caused by bacteria include tuberculosis (TB), food poisoning, bacterial meningitis and tetanus.

Athlete's foot is a fungal disease.

Fungi often grow on skin and release chemicals that digest skin cells. They can make the skin red and sore. Diseases caused by fungi include athlete's foot, ringworm and farmer's lung.

Chickenpox is caused by a virus.

Viruses take over body cells and force the cells to make millions of copies of the virus. The viruses then burst out and invade other nearby cells. They can also release chemicals which make you feel ill. Diseases caused by viruses include colds and 'flu, rabies, chickenpox, German measles, viral meningitis and AIDS.

How microbes enter the body

Your body is very good at keeping microbes out and preventing infection. The skin is a good barrier and stops microbes from getting into the blood. Your tears contain a chemical that destroys bacteria. But there are several ways that microbes can get past these defences and enter your body.

- Cuts in the skin allow microbes in.
- The food you eat can contain harmful microbes.
- The water you drink can carry water-borne microbes.
- Air has lots of microbes in it, which you can breathe in.
- **Sexually transmitted diseases**, such as AIDS, can be caught from sexual intercourse without protection.
- Animals can carry diseases and pass them on by biting you.

a **Make a table to show examples of diseases that the three types of microbe can cause.**

b What natural barriers does the body have against infection?

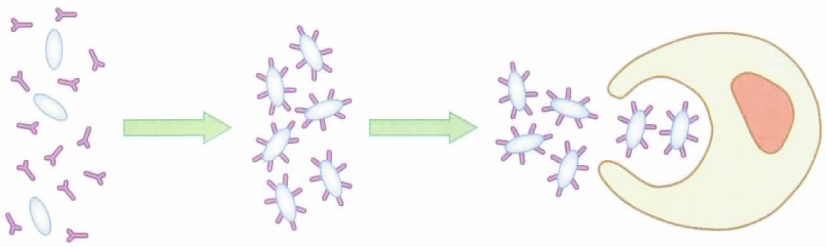
c Weil's disease is caused by bacteria that are sometimes found in canals and rivers. Explain how canoeists might get infected.

Fighting infection

Once microbes get inside the body, there is still another line of defence which can fight them and protect you. This is called the **immune system**. In the blood, there are **white blood cells** to help in the fight against microbes. They are a vital part of the immune system. They work in three different ways.

A white blood cell engulfing bacteria (orange rods).

1. Some white blood cells can engulf microbes.
2. White blood cells produce special chemicals called **antibodies** which attach themselves to the outside of the microbes. Antibodies may kill the microbes directly, or they may make them clump together, which makes it easier for white blood cells to engulf them.



3. White blood cells can destroy the toxins produced by microbes.

Becoming immune

An antibody is only able to recognise and fight one type of microbe. If your immune system has already met a microbe, it can make the antibodies more easily and your body can fight an infection a lot quicker. This makes you **immune** to the disease.

Antibodies can be passed from a mother to her baby across the placenta and also in breast milk. For their first few months after birth, babies are protected from some diseases like measles, because they have antibodies from their mother in their blood.

d Every year the virus that gives you a cold changes slightly. Explain why we catch colds every year.

Questions

1 **a** List four ways disease-causing microbes can enter your body.
b Describe how bacteria, viruses and fungi can make you ill if they get into your body.

2 Describe how white blood cells protect the body from infection.

3 Why is breast feeding better for babies than bottle feeding?

4 Survey your class to see who has had chickenpox, measles, mumps, colds and 'flu. Find out how many times each person has had each disease. For each disease find out:
a How many people have had the disease once?
b How many have had the disease more than once?
c What does this tell you about this disease?

For your notes:

- Microorganisms that cause **infection** are called **pathogens**.
- The first line of defence in the body is the skin.
- The **immune system** can fight off infection using **white blood cells** and **antibodies**.